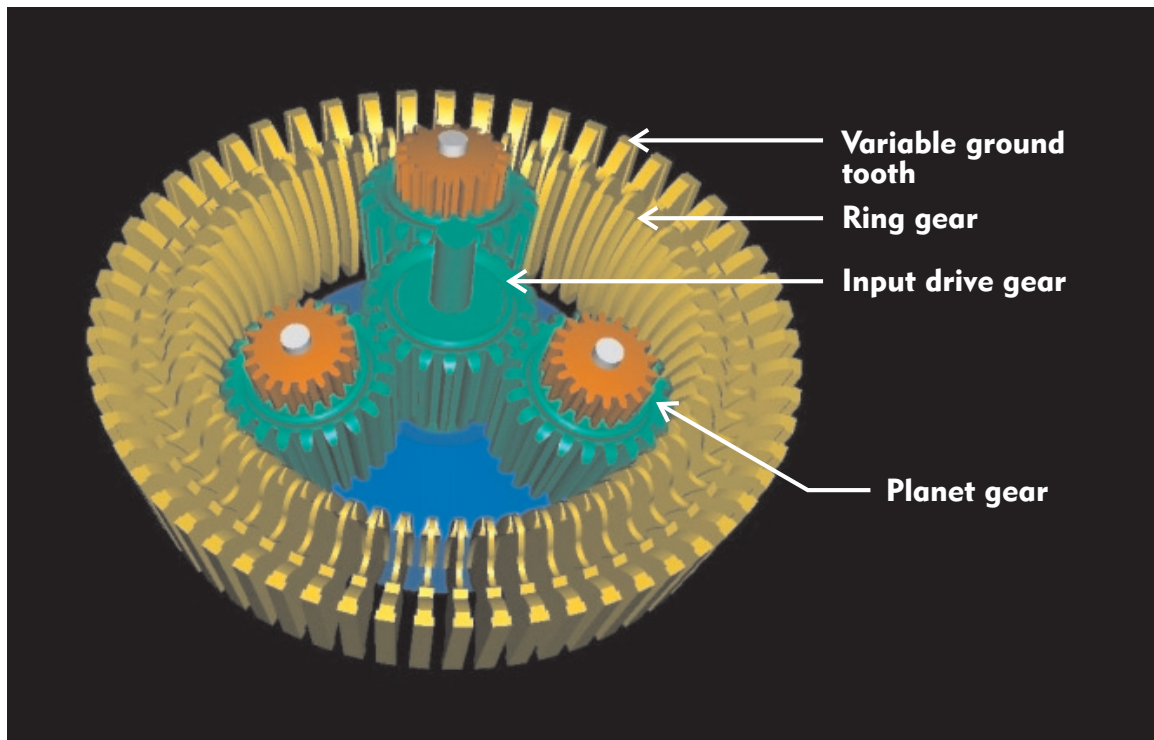


Technology Opportunity

Continuously Variable Planetary Transmission

The National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center seeks a qualified user to pursue commercialization of the Continuously Variable Planetary Transmission technology. The NASA design smoothly transmits torque from an engine to a drive-shaft, independent of engine speed; thereby improving vehicle acceleration and engine efficiency.



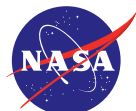
Potential Commercial Uses

With further development, the GSFC technology could be applied to many situations where power transmission must be adapted continuously to the power requirement.

- transportation vehicles,
- agricultural equipment, and
- machinery.

Benefits

Benefits of continuously variable transmissions (CVT) include smooth vehicle acceleration, power optimization, and increased engine efficiency. The NASA designed CVT can potentially offer several significant advantages over existing fixed gear transmissions. Further development of a working prototype would be necessary to optimize the design of the gear tooth and housings. These benefits are expected from the following design features:



- a planetary gear transmission that is continuously variable and provides forward, neutral and reverse directions.
- changing gear ratios under load can be accomplished without a clutch
- simple, compact design with few linkages and synchronizing gears; and
- “finger tip” control
- improved vehicle acceleration and fuel economy

The Technology

The NASA developed planetary transmission is designed to smoothly transmit torque from an engine to a drive-shaft, independent of the speed of the engine. The invention employs a system of planetary gears with conical sections that allow the point of gear mesh and mechanical action to move from near the base of the conical sections to the outer edge of the conical sections, resulting in a continuously variable gear ratio.

A rotating spur gear on an engine output shaft meshes with a spur gear on the input shaft of the transmission. A second, concentric spur gear on the transmission input shaft acts as a sun gear and drives the planet gears arrayed around the input shaft.

The three planet gears have a spur gear in their center which meshes with an output ring gear. The planet gears also have beveled gear sections and are tilted at an angle crucial to the design and operation of the CVT. The beveled planet gears transmit force to a moveable gear assembly which is comprised of a housing with multiple slots that hold individually moveable teeth. The moveable teeth contact the transmission housing, which helps synchronize the movements of the teeth with the movements of the shifting system. This causes the moveable gear assembly to increase or decrease the effective pitch diameter based on shift command inputs. This movement in turn changes the contact point of the moveable teeth within the beveled sections of the planet gears, thereby changing the effective gear ra-

tio. Since the contact point is continuously variable, so is the effective gear ratio.

In the NASA design, a combination ring gear and spur gear is used. When the CVT’s shift motors are operated to bring the shift mechanisms toward the middle of the transmission, the individual moveable teeth of the variable ground gear move so as to make point contact on a larger diameter of the beveled portion of the planet gears. This results in the equivalent to an “up-shift”. When the shift motors move the shift mechanisms apart, the teeth make contact on a smaller diameter of the beveled portion of the planet gears which is equivalent to down-shifting. Since the shifters move smoothly along the face of the driven gear teeth, the ratio changes continuously.

Commercial Opportunities

NASA’s Goddard Space flight Center seeks qualified users to pursue further development and commercialization of the Continuously Variable Planetary Transmission. The technology is available for technology transfer and licensing. A patent application has been filed for this technology.

Key Words

- Continuously Variable Transmission
- CVT
- Planetary Transmission

Contact

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